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## (54) MANUFACTURING METHOD FOR INK JET RECORDING PAPER

### (57)Abstract:

PROBLEM TO BE SOLVED: To provide a manufacturing method for ink jet recording paper wherein the ink jet recording paper having a higher printing quality than that of the ink jet recording paper manufactured by an off-machine coater, and being free from offset of ink even when it is printed by a high-speed ink jet printer and besides capable of being subjected to offset printing is manufactured by an on-machine coater.

SOLUTION: In the present manufacturing method of the ink jet recording paper, a coating which contains a pigment constituted mainly of silica and a binder containing a water-soluble polymer and a water-based resin and of which the content of the binder is 40-70 pts.wt. to 100 pts.wt. of the pigment is applied on a substrate by an on-machine process.

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## CLAIMS

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[Claim(s)]

[Claim 1] This binder content is the manufacture approach of the ink jet record form characterized by carrying out coating of the coating which is 40 - 70 weight section by the on-machine on a base material to said pigment 100 weight section including the binder containing the pigment, the water soluble polymer, and aquosity resin which made the silica the subject.

[Claim 2] Said water soluble polymer / aforementioned aquosity resin = the manufacture approach of the ink jet record form according to claim 1 characterized by being 50 / 50 - 20/80 % of the weight.

[Claim 3] The manufacture approach of the ink jet record form according to claim 1 or 2 characterized by for said water soluble polymer being polyvinyl alcohol, and said aquosity resin being an ethylene-vinyl acetate copolymer.

[Claim 4] The manufacture approach of the ink jet record form according to claim 1, 2, or 3 which carries out coating by the air knife coating machine, and is characterized by time amount until it measures the above-mentioned coating with the air knife after grant to a base material being 2 or less seconds in said on-machine coating.

[Claim 5] The manufacture approach of the ink jet record form according to claim 1, 2, 3, or 4 characterized by for the amount of water absorption from the ink acceptance side of an ink jet record form being two or more 40 g/m in 5 seconds, and an ethanol water-solution absorbed amount being two or more 50 g/m in 5 seconds.

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] When this invention is the approach of manufacturing the ink jet record form of the coat type which carries out and is manufactured by the off machine coating machine in more detail about the manufacture approach of an ink jet record form by the on-machine coating machine and is printed with an ink jet printer, the concentration of an image is high, and a color tone is clear, and the absorptance of ink is excellent, and offset printing is also related with the manufacture approach of a possible ink jet record form at coincidence.

[0002]

[Description of the Prior Art] Make the minute drop of ink fly with various regurgitation methods, and an ink jet recording method makes it adhere to record media, such as paper, and records an image, an alphabetic character, etc. A high speed, the low noise, and multiple-color-izing are easy, and have spread quickly as recording devices, such as a

color picture.

[0003] When the concentration of an ink dot being high and a color tone's being brightly skillful as a record form used by this ink jet recording method and a multicolor ink dot lap, ink flows out, it spreads, or the quick ink absorption for not carrying out is called for. furthermore -- recently -- printing speed -- much more -- quick -- becoming -- many -- when continuation printing of several sheets is carried out, the rear face (blank paper side) of the following recording paper laps with the printing section for a short time, and since there is a case where the phenomenon called the set-off from which the color of the printing section moves occurs, the further quick ink absorption is called for. Moreover, before printing with an ink jet printer, an alphabetic character and an image predetermined by offset printing may be printed.

[0004] In order to satisfy these demands, some proposals have accomplished from the former. The ink jet record form which prepared the paint film of ink absorptivity in the support surface is indicated by JP,55-5830,A, and coated paper with the two-layer structure where ink rate of absorption differs is indicated in JP,55-11829,A. Furthermore, in JP,6-55542,B, the No. [ 2618359 ] patent printing official report, and the No. [ 2618358 ] patent printing official report, the water solution by mixing of various solvents specifies the amount which permeates a record form in arbitration time amount, and is planning upgrading. By JP,6-55542,B, the polyethylene glycol of a degree of polymerization 400 and the rate of water have specified the amount of osmosis of the water solution of 1:1. The No. [ 2618359 ] patent printing official report and the No. [ 2618358 ] patent printing official report have specified the amount of osmosis in the arbitration contact time of the 30 % of the weight water solution of diethylene glycols.

[0005] The approach of using the off machine coating machine which is the method with which the process which manufactures a base material chiefly conventionally, and the process which carries out coating of the coating became independent as an approach of on the other hand manufacturing the ink jet record form classified into the coat paper type of high quality was in use. The coating for ink jets makes a water soluble polymer a subject as a synthetic silica and a binder as a pigment, and one of the reason of this has raised the solid content of a coating at the difficult point. The highest is also about 30 % of the weight, and the solid content of these coatings is usually 15 - 25 % of the weight.

[0006] On the other hand, in order to obtain the quality of printed character which should be satisfied, it is necessary to carry out coating of this coating to 10 g/m<sup>2</sup> order base material preferably two or more 5 g/m also at the lowest. In order to give the amount of coating predetermined in the low coatings of solid content, in the general transfer roll coater at an on-machine coating machine, size press, and a blade coating machine, it is difficult. Since the production process and coating process of a base material are performed continuously, another reason will result in a coating process at an on-machine coating machine in the condition that the base material warmed through the desiccation process after paper making has not got cold. That is, although a coating can be given to the base material in the condition of having got cold, in an off machine coating machine, a coating is given to the base material in the condition of having been warmed, in an on-machine coating machine.

[0007] Moreover, although a sizing compound is usually added by the production process of a base material in order to control osmosis of a coating, at an on-machine coating machine, a coating is given in the condition that whenever [ size ] is not fully discovered,

in many cases. \*\* et al. -- \*\* -- formation of the ink absorbing layer which the coating permeated the base material rapidly and had thickness sufficient on a base material in the situation is difficult compared with an off machine coating-machine method. These situations in an on-machine coating machine serve as unfavorable conditions extremely, for creating the ink jet record form of high quality.

[0008] On the other hand, since the base material production process and the coating process are continuing, the advantage of an on-machine coating machine excels the off machine coating machine in the routing counter, the operation staff, and the energy-efficiency side. If the ink jet record form of the high quality which endures an off machine coating machine by the on-machine coating machine excellent in productive efficiency and an energy-efficiency side can be manufactured, an industry top will also be a very desirable thing.

[0009]

[Problem(s) to be Solved by the Invention] In addition to the above-mentioned trouble, the following troubles were found out when this invention person etc. considered the manufacture approach of the ink jet record form of the high quality in an on-machine coating machine in view of the above situations. That is, it was what the remarkable fall of the strike-through of ink and surface reinforcement is accepted, and does not bear it especially about the fall of surface reinforcement at offset printing with deterioration of the quality of printed character represented by blot when it prints with an ink jet printer when the amount coating of the same coating of the same coating which checked that quality predetermined by the off machine coating machine was acquired is carried out to the on-machine coating machine which is the same coating method on the base material manufactured on the same conditions. Although the quality of printed character has improved a little when the amount of coating was increased in order to compensate deterioration of a quality of printed character, surface reinforcement fell further.

[0010] It is the high quality of printed character which endures the ink jet record form which the technical problem of this invention solved these troubles, and was manufactured by the off machine coating machine, and even if it prints with a high-speed ink jet printer, it is in offering the approach of manufacturing the ink jet record form which there is no set-off of ink and can offset by the on-machine coating machine.

[0011]

[Means for Solving the Problem] this invention person etc. found out that the coating formula itself was doubled with an on-machine coating machine, and it was necessary to redesign it, in order to solve the above-mentioned trouble, as a result of inquiring wholeheartedly. That is, this invention is constituted by the following.

(1) This binder content is made to carry out coating of the coating which is 40 - 70 weight section by the on-machine on a base material to said pigment 100 weight section including the binder containing the pigment, the water soluble polymer, and aquosity resin with which the manufacture approach of the ink jet record form concerning this invention made the silica the subject.

[0012] (2) Make the manufacture approach of the ink jet record form the above-mentioned (1) publication into said water soluble polymer / aforementioned aquosity resin = 50/50-20% / 80 % of the weight.

[0013] (3) Said water soluble polymer is polyvinyl alcohol, and said aquosity resin uses the manufacture approach of an ink jet record form the above (1) or given in (2) as an

ethylene-vinyl acetate copolymer.

[0014] (4) In said on-machine coating, carry out coating of the manufacture approach of an ink jet record form given [ above-mentioned ] in (1) - (3) by the air knife coating machine, and time amount until it measures the above-mentioned coating with the air knife after grant to a base material makes it 2 or less seconds.

[0015] (5) The amount of water absorption from the ink acceptance side of an ink jet record form is two or more 40 g/m in 5 seconds, and an ethanol water-solution absorbed amount makes the manufacture approach of an ink jet record form given [ above-mentioned ] in (1) - (4) two or more 50 g/m in 5 seconds.

[0016] Hereafter, this invention is shown in a detail. The pigment used into a coating in this invention makes a synthetic silica a subject. As a synthetic silica, a porosity silica with a mean particle diameter of 1-20 micrometers is used. Organic pigments, such as inorganic pigments, such as precipitated calcium carbonate, lime stone powder, a kaolin, talc, NI titanium oxide, a calcium sulfate, a barium sulfate, diatomaceous earth, colloidal silica, an alumina, a magnesium carbonate, and a caustic alkali of calcium, a plastics pigment, and a urea-resin, may be added if needed.

[0017] The binder used by this invention needs to use together a water soluble polymer and aquosity resin, a water soluble polymer improves the water retention of a coating, and the concentration at the time of printing with an ink jet printer, a blot and strike-through nature, and aquosity resin is used in order to improve a solid content rise of a coating, coating layer reinforcement, especially surface reinforcement. The amount of the binder used needs to be the range of 30 - 80 weight section to the pigment 100 weight section, and is 40 - 70 weight section still more preferably. Under in 30 weight sections, the surface reinforcement which is equal to offset printing is not obtained, but when 80 weight sections were exceeded and it prints, a blot occurs.

[0018] The ratio of a water soluble polymer and aquosity resin needs to be 50 / 60 - 20/80 % of the weight. If the ratio of a water soluble polymer exceeds 50 % of the weight, it becomes difficult for the solid content of a coating to fall and to give the predetermined amount of coating, printing concentration falls, and while a blot gets worse, it will become easy to carry out a strike-through at less than 20 % of the weight. The optimal ratio measures the water absorbed amount and ethanol water-solution absorbed amount which carry out a postscript, and can determine them on balance with the amount of binders.

[0019] As a water soluble polymer, polyvinyl alcohol, silyl denaturation polyvinyl alcohol, a carboxymethyl cellulose, hydroxyethyl cellulose, the various derivative of starch, gelatin, casein, acrylamide, soybean protein, polyvinylpyrrolidone, etc. are mentioned, and it can be used by independent or plurality. But poly vinyl alcohol is desirable.

[0020] As aquosity resin, an ethylene-vinyl acetate copolymer, a styrene-butadiene copolymer, an acrylic polymer, urethane system resin, melamine resin, and a urea-resin are mentioned, and it can be used by independent or plurality. It is the thing with the polyvinyl alcohol which especially a desirable thing is an ethylene-vinyl acetate copolymer, and is a water soluble polymer in this to combine, and the ink jet record form which was compatible in reinforcement and an ink jet printing property is obtained. Furthermore, a pigment agent, a thickener, a defoaming agent, a release agent, a color pigment, a fluorescent brightener, a deck-watertight-luminaire-ized agent, a wetting

agent, etc. can be suitably blended as other additives.

[0021] The raw material of the stencil paper used as a base material by this invention uses natural fibers, such as wood pulp mainly represented by L-BKP and N-BKP, recycled pulp, and herb vegetable pulp. Although the degree of beating is balance with paper durability reinforcement, in order to raise the absorption capacity of ink, the coarsest possible thing is desirable. Into pulp, a paper durability agent, a loading material, a band, a sizing compound, a yield improver, a color, fluorescent dye, etc. are used suitably.

[0022] Cation starch and poly acrylamide are used as a paper durability agent. As a loading material, a calcium carbonate, talc, clay, permutite, a calcium silicate, titanium, etc. are used. When using a calcium carbonate for a loading material as a sizing compound, an alkyl ketene dimer, alkenyl succinyl oxide, neutral rosin, etc. are used, and strengthening rosin and saponification rosin are mainly used in loading materials other than a calcium carbonate. Although the addition of a sizing compound is made into extent which does not check water absorption, it is almost additive-free. As for a yield improver, colloidal silica, poly acrylamide, polyethyleneimine, etc. are used. A color and fluorescent dye are added in order to adjust the hue of paper, and direct dye, basic dye, acid dye, etc. are used.

[0023] Stencil paper paper milling is performed by a round mesh, a Fortlinear paper machine, the Fortlinear paper machine to which the top wire was attached. It is an effective approach to apply coating liquid, such as starch, polyvinyl alcohol, and a surface sizing compound, with the equipment represented by size press, the gate roll, etc. in advance of the coating of an ink acceptance layer, in order to control too much osmosis of the coating at the time of on-machine coating.

[0024] As equipment at the time of carrying out coating of the coating for ink jets by the on-machine, although there are various kinds of coating equipments, the rod coating machine and air knife coating machine which can carry out abundant grant of the low-concentration coating also at a comparatively low coating rate called the following by 500m/are desirable. Especially desirable equipment is an air knife coating machine. Time amount (it is henceforth called a duel time) when using an air knife coating machine, until it measures a coating with the air knife after grant in stencil paper is important, and when said coating is used, the ink jet recording paper both the reinforcement and qualities of printed character of an ink acceptance layer excelled [ recording paper ] in making it 2 or less seconds can be obtained.

[0025] In on-machine coating, if a duel time is important compared with the case in off machine coating and exceeds 2 seconds, osmosis in the stencil paper to the binder component in a coating will progress, and required coating layer reinforcement will become is hard to be obtained. If the quantity of a binder is increased on the other hand in order to raise coating layer reinforcement, the rate of absorption of ink and a blot will get worse, and a quality of printed character will deteriorate.

[0026] The amount of coating of an ink acceptance layer has the desirable range of 5 g/m<sup>2</sup> - 18 g/m<sup>2</sup>. It is 8 - 15 g/m<sup>2</sup> still more preferably. In less than two 5 g/m, when it prints with an ink jet printer, a blot occurs, and printing grace, such as clearness and homogeneity, is dissatisfied and it is easy to generate a blot. On the other hand, if 18 g/m<sup>2</sup> is exceeded, although homogeneity is good, ink drying, ink concentration, and reinforcement fall and are not desirable [ homogeneity ]. The record form by which coating was carried out can prevent omission of the pigment from an ink acceptance layer

by making a front face smooth using a calender, a super calender, a raster press, etc. through a desiccation process.

[0027] It is desirable that the amount of water absorption from the ink acceptance side of an ink jet record form is two or more 40 g/m in 5 seconds, and an ethanol water-solution absorbed amount adjusts to two or more 50 g/m in 5 seconds by this invention. When the absorbed amount for [ of water ] 5 seconds is less than two 40 g/m, absorption of ink is slow, and when the paper after printing is piled up, the dirt with which ink is called \*\*\*\*\* striped \*\*\*\*\* to the rear face of the following paper is generated. In less than two 50 g/m, the absorbed amount of an ethanol water solution has slow absorption of ink, and the phenomenon in which the boundary of each color ink spreads does not generate and have it. [ desirable ]

[0028] The liquid absorbed amount from the ink acceptance side of an ink jet record form is contacted to the ink acceptance side of the fixed area during 5 seconds at 20 degrees C using water or an ethanol water solution (ethanol: the weight ratio of water 25:75 solutions), removes excessive liquid with a blotting paper, measures the weight of the water absorbed from the ink acceptance side, and means the value computed more than as g per two 1m here. A liquid absorbed amount is influenced by both absorptivity of stencil paper, and absorptivity of an ink acceptance layer.

[0029]

[Example] Although an example is raised to below and explained to a detail, the section and % in an example express weight section and weight %, and each addition is the amount of weight solid content conversions. It is not restricted at all by these examples. As opposed to L-BKP which carried out beating to example 1 Canadian standard freeness (CSF) 500cc For talc a commercial rosin size agent (product made from a koro pearl E-5H star photochemistry) 10% as a loading material 0.02%, After adding sulfuric-acid band 0.5% and carrying out slurry adjustment, the stencil paper of U.S. tsubo 180 g/m<sup>2</sup> is milled using a Fortlinear paper machine. The pasty liquid of an oxidized starch so that it may become solid content conversion 2.5 g/m<sup>2</sup> (both sides) by size press Subsequently, after grant, One side 10 g/m<sup>2</sup> coating of the coating following by the on-machine air knife coating machine was carried out, it passed like the fitter by the desiccation process and the calender, and the ink jet record form of U.S. tsubo 190 g/m<sup>2</sup> was obtained. The duel time at the time of air knife coating-machine coating was 0.8 seconds.

<Coating liquid presentation> Synthetic silica ; Fine seal (Tokuyama make) The 100 sections Polyvinyl alcohol ;P VA117 (Kuraray Co., Ltd. make) The 20 sections Ethylene acetic-acid vinyl polymer; SUMIKA flex time 444HQ (Sumitomo Chemical make) The 30 sections Cationic color binder; quarternary-ammonium-salt mold polymer The ten sections Solid content weight 20% [0030] The ink jet record form was obtained like the example 1 except having made the polyvinyl alcohol under coating liquid presentation into the 20 sections and the ethylene acetic-acid vinyl polymer 40 section in example 2 example 1.

[0031] The ink jet record form was obtained like the example 1 except having made the polyvinyl alcohol under coating liquid presentation into the 15 sections and the ethylene acetic-acid vinyl polymer 45 section in example 3 example 1.

[0032] The ink jet record form was obtained like the example 1 except having made the polyvinyl alcohol under coating liquid presentation into the 20 sections and the ethylene acetic-acid vinyl polymer 15 section in example of comparison 1 example 1.

[0033] The ink jet record form was obtained like the example 1 except having made the polyvinyl alcohol under coating liquid presentation into the 30 sections and the ethylene acetic-acid vinyl polymer 45 section in example of comparison 2 example 1.

[0034] The ink jet record form was obtained like the example 1 except having added the commercial rosin size agent (product made from a koro pearl E-5H star photochemistry) 0.1% in example of comparison 3 example 1.

[0035] The ink jet record form was obtained like the example 1 except having made the dwell time at the time of air knife coating-machine coating into 2.2 seconds in example of comparison 4 example 1.

[0036] It rolled round to the reel, without carrying out coating by the on-machine after stencil paper paper milling in example of comparison 5 example 1, the off machine air knife coating machine was used for one side of this stencil paper after that, and the ink jet record form was obtained like the example 1 except having carried out coating of the same coating.

[0037] The evaluation approach (1) The printing on-the-strength RI printing machine (product made from \*\*\*\*\*) was used, it printed to the ink acceptance side using commercial offset ink, and the picking (skin) condition was observed. O and the case where it generated were evaluated for the case where a picking does not occur, as x.

[0038] (2) As a printer of ink jet printer printing evaluation \*\* printing evaluation 1 standard printing speed, it is a product made from Canon. It printed using photograph ink with the ink jet printer BJC430. The boundary blot of cyanogen (C) and a Magenta (M) estimated the ink blot. The case where a boundary blot did not occur evaluated by x, when generating, O and. The strike-through evaluated as O x and the case where it did not come out for the case where observe visually and ink comes out to an ink jet side and an opposite side.

\*\* As a printer of printing evaluation 2 quantity printing speed, it is a product made from Canon. It printed using ink jet printer (card printer) P400-C. About the ink blot and the strike-through, it evaluated like the approach indicated to the printing evaluation 1. The set-off carried out ten-sheet continuation printing, and evaluated as O x and the case where there was [ \*\*\*\*\* ] nothing for the case where ink transfers at least one sheet to the rear face of inkjet printing paper. The above result was shown in Table 1.

[0039]

[Table 1]

	実施例1	実施例2	実施例3	比較例1	比較例2	比較例3	比較例4	比較例5
塗工方式	オンマシ	オンマシ	オンマシ	オンマシ	オンマシ	オンマシ	オンマシ	オンマシ
バインダー濃度	50	60	60	35	75	50	50	35
PVA/エチレン酸比重量比	40/60	33/67	25/75	40/60	40/60	40/60	40/60	40/60
フィルム厚	0.8	0.8	0.8	0.8	0.8	0.8	2.2	0.8
水吸着量 g/m <sup>2</sup>	50	48	42	80	20	30	25	65
エタノール吸着量 g/m <sup>2</sup>	60	62	65	70	45	55	45	75
印刷強度	○	○	○	×	○	○	×	○
印字評価1	しみ	○	○	○	×	○	×	○
	高抜け	○	○	○	×	○	×	○
印字評価2	高抜け	○	○	○	×	×	×	○
	しみ	○	○	○	×	×	×	○
	高抜け	○	○	○	×	×	×	○



[0040] Although a comparison when the example 1 of a comparison and the example 5 of a comparison carry out coating of the coating for the same ink jets by the on-machine coating machine and the off machine coating machine is shown, it is admitted in an on-machine coating machine that printing reinforcement falls. When coating is carried out by the same on-machine coating machine, compared with the examples 1-4 of a comparison, it is clear that the examples' 1-3 belonging to this invention the balance of printing reinforcement and a quality of printed character is excellent.

[0041]

[Effect of the Invention] According to this invention, it becomes possible to also manufacture the on-machine coating machine the coat paper type ink jet record form of the high quality currently conventionally manufactured by the off machine coating machine chiefly excels [ coating machine ] in productive efficiency and energy efficiency. Moreover, even if it corresponds to improvement in the speed of an ink jet printer and prints at high speed, it becomes possible to offer the ink jet record form which does not have a set-off and has the versatility which can offset.

[0042] Moreover, by this invention, by making the amount of the binder used into the range of 40 - 70 weight section to the pigment 100 weight section, under in 30 weight sections, when the surface reinforcement which is equal to offset printing is not obtained, but 80 weight sections were exceeded and it prints, it is canceled that a blot occurs.

[0043] Furthermore, in this invention, if the ratio of a water soluble polymer exceeds 50 % of the weight by making the ratio of a water soluble polymer and aquosity resin into 50 / 60 - 20/80 % of the weight, while it becomes difficult for the solid content of a coating to fall and to give the predetermined amount of coating, printing concentration falls at less than 20 % of the weight and a blot gets worse, it is cancelable to become easy to carry out a strike-through.

[0044] Moreover, this invention is the thing with polyvinyl alcohol to combine as an ethylene-vinyl acetate copolymer and a water soluble polymer as aquosity resin, and the ink jet record form which was compatible in reinforcement and an ink jet printing property is obtained.

[0045] This invention can obtain the ink jet recording paper excellent in both the reinforcement and qualities of printed character of an ink acceptance layer further again by making time amount (it being henceforth called a dwell time) until it measures a coating with the air knife after grant in stencil paper into 2 or less seconds, when using an air knife coating machine in on-machine coating.

[0046] And in this invention, dirt generating by which the amount of water absorption from the ink acceptance side of an ink jet record form is two or more 40 g/m in 5 seconds, and ink is called \*\*\*\*\* striped \*\*\*\*\* to the rear face of the following paper even when an ethanol water-solution absorbed amount adjusts to two or more 50 g/m in 5 seconds and the paper after printing is early piled up by absorption of ink is canceled.